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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 09/870,534
Filing Date: May 31, 2001
Appellant(s): SRIVASTAVA ET AL.

Ira D. Blecker
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 4/6/2007 appealing from the Office action mailed 8/24/2006.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings, which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

5,340,437	ERK	8-1994
5,462,638	DATTA	10-1995
5,445,705	BARBEE	8-1995

Takeshi et al., Method and Apparatus for Evaluating Semiconductor Substrate, (May 2, 1997), English translation of JP 9115977A2, 17 pages.

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

1. Claims 1, 4, 5, and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Erk (US 5,340,437) in view of Datta et al. (US 5,462,638).

As pertaining to claims 1, 4, and 5, Erk teaches a method comprising the steps of:

immersing an article into a tank of etchant (column 7, lines 13-17).

Erk also teaches, " . . . the wafers are etched . . . for a period of about 1 to 10 minutes . . . wafers are rotated while they are in contact with the flowing etchant . . . the wafers are rotated at a speed less than about 5 rpm" (column 4, lines 19-26). "As the etchant flows into the etch tank, . . . the drive mechanism . . . are rotated to cause the semiconductor wafers rotate . . ." (column 7, lines 17-24 and column 8, lines 30-32), which reads on rotating the article while in the etchant for an amount of time so as to cause improved uniformity of etching of the film across the entire article compared to etching without rotating the article; and

removing the article from the tank of etchant (column 8, lines 38-42).

Erk differs in failing to teach the article contains a film having a plurality of solder bump on an article and immersing the solder bumps into a tank of etchant, **in claim 1** and the film is a metallic film, **in claim 6**.

Datta teaches, "After the solder bumps are formed, . . . The substrate now is covered with . . . solder bumps" (column 3, lines 10-12). "The etchant removes Ti-W . . ." It can be used with dip etching" (column 7, lines 41-44). The former reads on the article contains a film having a plurality of solder bump on an article and the latter reads on immersing the article containing the film having a plurality of solder bumps into a tank of etchant, as **in claim 1** and the above further reads on the film is a metallic film, as **in claim 6**. Datta illustrates that wafers with solder bumps are conventionally etched by dip etching.

It would have been obvious to one having ordinary skill in the art at the time of the claimed invention to employ any wafer, including a conventional wafer having solder bumps as disclosed by Datta in the process of Erk because Erk does not limit the specific types of wafers processed by the rotating etching process. It would appear that any wafer, including one with solder bumps, would benefit from the uniform etching process of Erk. Appellants have not shown anything unexpected by employing a conventional wafer with solder bumps in a known process for achieving uniform etching.

2. Claims 2 and 3 are rejected under 35 U.S.C. 103(a) as being unpatentable over Erk (US '437) in view of Datta (US '628) as applied to claim 1 above, and further in view of Takeshi et al. (English Abstract of JP 9115977 A2).

Erk in view of Datta differs in failing to teach the step of rotating comprises sequentially rotating the article, **in claims 2 and 3**; and

sequentially rotating comprises rotating the article an amount but less than a complete rotating and repeating the steps of rotating and etching for an amount of time, **in claim 3**.

It is well known in the art that a complete rotation is 360 degrees. Takeshi teaches the steps of setting a fixed angular velocity so that the total angle of rotation becomes less than 360 degrees [0025 and 0028], which reads on rotating the article a predetermined amount but less than a complete rotation. Takeshi also teaches repeating the step of rotating and etching for an amount of time [0030], further reads on sequentially rotating comprises rotating the article an amount but less than a complete rotating.

It would have been obvious to modify Erk in view of Datta by using Takeshi's step of sequentially rotating an article for an amount but less than a complete rotation, and repeating the steps of rotating and etching for an amount of time for the purpose of improving the method of detecting defects in semiconductor processing.

3. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Erk (US 437) in view of Datta (US '638) as applied to claim 1 above, and further in view of Barbee (US '705).

Erk in view of Datta differs in failing to teach the film is a non-metallic film.

Barbee teaches a workpiece **20**, such as a semiconductor wafer comprises one or more film layers on a surface thereof, the film layers are either patterned or unpatterned (column 5, lines 42-50; column 7, lines 67 - column 8, line 7) and " . . . the

removal of a conducting or dielectric film from the etched work piece **20** . . ." (column 6, lines 63-64), which reads on the article containing a film being non-metallic.

Hence, it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Erk in view of Datta by using an article containing a film as taught by Barbee for the purpose monitoring an etching condition of a workpiece being etched which does not interfere with the impingement of an etchant upon a workpiece (Barbee, column 3, lines 17-21).

4. Claims 8, 11, 12, and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Erk (US '437) in view of Datta (US '638).

Erk teaches a method comprising the steps of:

immersing a semiconductor into a tank of etchant (column 7, lines 13-17);

Erk also teaches, " . . . the wafers are etched . . . for a period of about 1 to 10 minutes . . . wafers are rotated while they are in contact with the flowing etchant . . . the wafers are rotated at a speed less than about 5 rpm" (column 4, lines 19-26). "As the etchant flows into the etch tank, . . . the drive mechanism . . . are rotated to cause the semiconductor wafers rotate . . ." (column 7, lines 17-24), which reads on,

rotating the semiconductor wafer while in the etchant for an amount of time; and

"The wafers are etched . . . for . . . 1 to 10 minutes . . . the flow of liquid continues . . . and the etch rack is removed from the etch tank . . . to remove any etchant which may remain on the surface of the wafers" (column 8, lines 30-42) and " . . . the wafers are rotated at a speed less than 5 rpm . . ." (column 4, lines 19-21), which reads on,

removing the semiconductor from the tank of etchant), as **in claim 8**;

rotating comprises continuously rotating the semiconductor wafer an amount of time, as **in claim 11**; and

rotating the semiconductor wafer at a speed of 1 to 5 revolutions per minute, as **in claim 12**.

Erk differs in failing to teach the semiconductor contains a film having a plurality of solder bump on an article and immersing the solder bumps into a tank of etchant, **in claim 8** and the film is a metallic film **in claim 14**.

Datta teaches, "After the solder bumps are formed, . . . The substrate now is covered with . . . solder bumps" (column 3, lines 10-12). "The etchant removes Ti-W . . ." It can be used with dip etching" (column 7, lines 41-44). The former reads on the article contains a film having a plurality of solder bump on the article and the latter reads on immersing the article containing the film having a plurality of solder bumps into a tank of etchant, as **in claim 8**. The above further reads on the film is a metallic film, as **in claim 14**. Datta illustrates that wafers with solder bumps are conventionally etched by dip etching.

It would have been obvious to one having ordinary skill in the art at the time of the claimed invention to employ any wafer, including a conventional wafer having solder bumps as disclosed by Datta in the process of Erk because Erk does not limit the specific types of wafers processed by the rotating etching process. It would appear that any wafer, including one with solder bumps, would benefit from the uniform etching

process of Erk. Appellants have not shown anything unexpected by employing a conventional wafer with solder bumps in a known process for achieving uniform etching.

5. Claims 9 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Erk (US '437) in view of Datta (US '638) as applied to claim 8 above, and further in view of Takeshi (English translation of JP '977 A2).

Erk in view of Datta differs in failing to teach the step of rotating comprises sequentially rotating the semiconductor, **in claims 9 and 10**; and

sequentially rotating comprises rotating the semiconductor an amount but less than a complete rotating, and repeating the steps of rotating and etching for an amount of time, **in claim 10**.

It is well known in the art that a complete rotation is 360 degrees. Takeshi teaches the steps of etching a semiconductor by setting a fixed angular velocity so that the total angle of rotation becomes less than 360 degrees and etching for a fixed time [0025 and 0028], which reads on rotating the article an amount but less than a complete rotation. Takeshi also teaches repeating the step of rotating and etching for an amount of time [0030].

It would have been obvious to modify Erk in view of Datta by using Takeshi's step of sequentially rotating an article for the purpose of improving the method of detecting defects in semiconductor processing.

6. Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Erk (US 437) in view of Datta (US '638) as applied to claim 8 above, and further in view of Barbee (US '705).

Erk in view or Datta differs in failing to teach the film is a non-metallic film.

Barbee teaches a workpiece **20**, such as a semiconductor wafer comprises one or more film layers on a surface thereof, the film layers are either patterned or unpatterned (column 5, lines 42-50; column 7, lines 67 - column 8, line 7) and " . . . the removal of a conducting or dielectric film from the etched work piece **20** . . ." (column 6, lines 63-64), which further reads on the semiconductor containing a film being non-metallic, as in the claimed invention.

It would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Erk in view or Datta by using an article containing a film as taught by Barbee for the purpose monitoring an etching condition of a workpiece being etched which does not interfere with the impingement of an etchant upon a workpiece (Barbee, column 3, lines 17-21).

(10) Response to Argument

It is noted:

Grounds of Rejection I is clearly argued in Argument Section I;

Grounds of Rejection II and III are argued in Argument Section II;

Grounds of Rejection IV is argued in Argument Section III; and

Grounds of Rejection V and VI are argued in Argument Section IV.

I. Appellants traversed the 35 U. S. C. §103(a) rejection of claims 1, 4, 5, and 6 over Erk (US 5,340,437) in view of Datta et al. (US 5,462,638). Appellants argue, Erk teaches etching a bare silicon wafer that has been sawed and lapped, immersed in an etchant bath and then rotated in order to remove residual effects of sawing and lapping; to uniformly etch the bare silicon wafer at slow rotation speeds; and to have relatively low total thickness variation across the wafer. Hence, there is nothing in the teachings of Erk that would be applicable to any other process other than the removal of residual effects; that would be the same as uniformly etching a film across the entire wafer as taught by Appellants; and that would be applicable to improving the uniformity of etching of a film having a plurality of solder bumps as claimed by Appellants, since it cannot be assumed that the teaching of a bare wafer as taught by Erk would be applicable to etching of a wafer with a film having a plurality of solder bumps. Appellants also argue Datta, which is directed to etching one of the TiW metallic films underlying the solder bumps by dip etching, fails to cure Erk's deficiencies.

Appellants' arguments of Datta's failure to cure Erk's deficiencies are acknowledged. But Appellants' arguments are unpersuasive because Erk has provided a process in which wafers can be uniformly etched at relatively slow rotation speeds (column 2, lines 13-18) compared to etching wafer by rotation at relatively high speeds to minimize nonuniformity. Further, it has been shown that Erk teaches a method wherein an article is immersed in, rotated in and removed from a tank containing etchants (column 4, lines 19-26; column 7, lines 17-24; column 8, lines 30-32; and column 8, lines 38-42), while Datta has shown an article having a plurality of solder

bumps. Hence, it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to employ any wafer, including a conventional wafer having solder bumps as disclosed by Datta in the process of Erk because Erk does not limit the specific types of wafers processed by the rotating etching process. It would appear that any wafer, including one with solder bumps, would benefit from the uniform etching process of Erk.

Appellants disagree with Examiner's reasoning (motivation) for combining Erk and Datta. Appellants argue the combination is directed to two different types of processes with two different kinds of wafers. Appellants argue Erk is specific to wafers that are worked damaged so to remove residual effects of sawing and lapping and to wafer that lack film layer and lack solder bumps but are immersed and rotated in an etching bath, while Datta has wafers that have a metallic film layer but etches the wafer in a cassette-type dip etching process.

In response to Appellants' argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, the reason for combining Erk and Datta is that since Erk does not limit the specific types of wafers

processed by the rotating etching process, then it would appear that any wafer, including one with solder bumps as taught by Datta, would benefit from the uniform etching process of Erk.

Appellants also disagree with Examiner's conclusion of Appellants' failure to show anything unexpected by employing a conventional wafer with solder bumps in a known process for achieving uniform etching. Appellants argue they have shown unexpected result in their Specification and depending on the test methodology used, have found improvement of 34% or 78% (page 15 of Appellants' Specification), which is surprising and unexpected.

Appellants' results are acknowledged but unpersuasive because Appellants have failed to show the amount of improvement would overcome the applied references. Since the combined teaching of the references would have been provided for rotating the wafer with a solder bump, then the alleged results cannot overcome the rejection.

Appellants argue claims 4 to 6 depend from claim 1, which is believed to be allowable and assert no independent ground of patentability for claims 4-6.

II & III Appellants traverse the rejection of claims 2 and 3, and 7 over Erk in view of Datta and further in view of Takeshi et al. ((JP 9115977) and the rejection of claim 7 over Erk in view of Datta and further in view of Barbee et al. (US 5,445,705).

Appellants argue, claims 2 and 3 are believed to be independently patentable; the combination of Erk, Datta, and Takeshi "for the purpose of improving the method of detecting defects in semiconductor processing" teaches a solution to a problem not faced by Appellants; and Takeshi is nonanalogous art.

It is acknowledged that Erk in view of Datta differs in failing to teach the step of rotating comprises sequentially rotating the article, **in claims 2 and 3**. However, Takeshi teaches repeating the step of rotating and etching for an amount of time [0030], which reads on sequentially rotating comprises rotating the article an amount. Hence, it would have been obvious to modify Erk in view of Datta by using Takeshi's step of sequentially rotating an article for the purpose of improving the method of detecting defects in semiconductor processing, which thereby makes claims 2 and 3 as being unpatentable.

In response to Appellants' argument that Takeshi is nonanalogous art and should be withdrawn as a reference is nonanalogous art, it has been held that a prior art reference must either be in the field of applicant's endeavor or, if not, then be reasonably pertinent to the particular problem with which the applicant was concerned, in order to be relied upon as a basis for rejection of the claimed invention. See *In re Oetiker*, 977 F.2d 1443, 24 USPQ2d 1443 (Fed. Cir. 1992). In this case, Takeshi is analogous art because it is directed to a method of etching a wafer, which is immersed and rotated in an etchant and removed while observing the wafer for defects (Abstract, [0017-0018], which illustrates the same field of endeavor is "etching."

Appellants argue claims 2, 3, and 7 depend from claim 1, which is believed to be allowable and assert no independent ground of patentability for claim 7.

IV & V Appellants traverse the rejection of claims 8, 11, 12, and 14 over Erk in view of Barbee for the same reason as recited above in claim 1. Appellants' arguments are acknowledged and the same rationale to show Appellants' arguments is unpersuasive in claim 1, above is also applicable to claim 8.

It is noted that the Appellants assert no independent ground of patentability for claims 11, 12, and 14.

IV. Appellants traverse the rejection of claims 9 and 10 over Erk in view of Datta and further in view of Takeshi and claim 15 over Erk in view of Datta and further in view of Barbee for the same reason as recited above in claim 8.

Appellants' arguments are acknowledged and the same rationale to show Appellants' arguments is unpersuasive in claims 2, 3, and 8, above is also applicable to claims 9 and10. It is noted that Appellants assert no independent ground of patentability for claim 15.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

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ltue

June 7, 2007

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